

# **Report**

## **NEAT Working Group on Energy Security Cooperation in East Asia (Phase III: Energy Diversification)**

**Singapore**

**27 April 2007**

## **I Introduction**

1 The NEAT Working Group (WG) on Energy Security Cooperation in East Asia met in Singapore on 27 April 2007. The WG was chaired by the East Asian Institute, Singapore's NEAT Country Coordinator. The delegates included scholars and experts from the ASEAN Plus Three (APT) countries. A delegation list is at [Annex](#).

2 This is the third meeting of the WG since it was formed in 2004. The first meeting (Phase I) on 6 May 2005 focused on the energy outlook in the region and maritime security in energy transport. The second meeting (Phase II) on 30 June 2006 looked at energy efficiency and energy conservation. The theme for the third meeting (Phase III) was on energy diversification in the APT countries.

3 The meeting covered three main aspects, namely: (a) the issue of energy diversification in the APT countries, (b) potential, challenges and problems of energy diversification, and (c) possible areas for regional cooperation in energy diversification.

4 The meeting is timely in the wake of continuing volatility in oil prices, growing uncertainty over long-term energy supply and rising concerns over the environmental impact of fossil fuels use. This report highlights the major issues raised at the WG meeting, including possible areas for bilateral and regional cooperation among APT countries.

5 The report, prepared by NEAT Singapore and after the endorsement of the delegates to the WG, will be submitted to the 5<sup>th</sup> Annual Conference of NEAT to be held in Singapore in August 2007.

## **II The Issue of Energy Diversification**

6 Energy diversification is conventionally defined as a move away from reliance on either one or two primary sources of energy, usually fossil fuels, to non-fossil fuels.

While each APT country has a different mix in its overall energy utilisation, the meeting noted that most APT countries are predominantly dependent on either one or two fossil fuels. Countries like Brunei, Cambodia, Myanmar, Singapore and Vietnam are heavily dependent on fossil fuels (almost up to 100%) while Japan is the least dependent on fossil fuels (84%) followed by Korea (85%) and the Philippines (92%). Given the heavy reliance on fossil fuels, the governments of all the APT countries are making concerted efforts to diversify their energy sources and vary their energy mix.<sup>1</sup>

7 The meeting highlighted a number of factors behind energy diversification efforts. From the political and security perspectives, diversifying energy sources and varying the energy mix would enable countries to better withstand energy supply shocks in the short run and demand squeeze due to sudden surge in demand coupled with insufficient investment in energy infrastructure to keep up with the demand. On the economic front, a sharp and sustained rise in oil prices would make renewable sources of energy more commercially viable. Technological progress may also bring down the costs of renewable sources of energy, thus increasing their commercial viability. The growing concerns for the environment and global warming provide a strong impetus to search for cleaner substitutes.

8 The APT countries are at different stages of economic development, so are they for energy diversification. In Northeast Asia, Japan has introduced nuclear power and natural gas to reduce its reliance on oil. China is tapping oil and renewables such as hydro, wind and solar power to reduce its dependence on coal. Korea is reducing its coal and oil demand by looking at gas, nuclear and waste incineration. In Southeast Asia, Brunei is making nascent efforts to move away from oil and gas while Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand and Vietnam have had varying success in diversifying into fossil fuels (other than oil), hydro power and other renewables. Singapore, with its heavy reliance on oil and gas, is diversifying within these two sources and exploring renewable sources of energy.

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<sup>1</sup> For more details, see [Appendix](#).

### **III Potential, Challenges and Problems of Energy Diversification**

9 The potential, challenges and problems of energy diversification for individual APT countries are closely related to their respective levels of economic development and resource endowment, and their respective government priorities and policies toward energy diversification. What are listed below just highlight some key issues that countries in the region must grapple with. Naturally, some countries face more challenges and problems than others.

10 In brief, the key reasons for lack of sufficient energy diversification efforts in the APT countries include: 1) the availability of capital, technology and trained human resources, 2) the political costs and social inertia involved in shifting from one or two energy sources to others; 3) the comparatively high cost of renewable sources of energy at the present state of technology, 4) the level of social awareness and acceptance of alternative energy resources such as nuclear power, and, 5) the set of government policies and incentives, and the importance of coordination among relevant ministries and agencies.

### **IV Implications for Regional Cooperation**

11 Although energy diversification is largely undertaken by the individual APT governments, there is room for cooperation at regional level. Such cooperation will serve a number of purposes. First, it can help complement national policies and actions. Second, it can address issues of common interest or concern such as the safe use of nuclear energy and safe disposal of nuclear waste. Third, it can lead to optimal use of existing or potential assets such as joint exploration and joint stockpiling.

12 Regional cooperation in energy diversification should cover:

- Sharing of information, technology and know-how on the use of both fossil and non-fossil fuels

- Exploring viable alternatives, particularly renewable sources of energy
- Removing impediments to cross-border investments for energy diversification projects
- Promoting greater use of natural gas in the short run

13 The meeting takes the view that the APT governments should actively identify and push for ways and means to diversify sources of energy and promote regional cooperation in this area. Given the unique experiences and strengths of each country's energy diversification efforts, regional cooperation can result in better synergies and more cost-effective solutions, and promote economies of scale.

14 By working together, more eco-friendly ways of generating power can also be found and shared which will safeguard the environment. The region's long-term sustainable growth and stability critically depends on whether or not the region can effectively address its energy needs by taking into account individual national priorities and interests, as well as overall environmental considerations.

## **V Policy Recommendations**

15 Below are some of the key recommendations and suggestions by the WG on energy diversification to the APT governments:

- (i) Recommendation 1: To explore all possible avenues related to energy cooperation for APT countries, especially in the areas of energy conservation and diversification.
- (ii) Recommendation 2: To facilitate the sharing of information, technology and know-how on the use of both fossil and non-fossil fuels for APT countries. In particular, more advanced APT countries should consider sharing energy-saving technology with others.

- (iii) Recommendation 3: To explore viable alternatives, particularly renewable sources of energy e.g. safe nuclear energy, clean coal, solar energy and biofuels. APT countries should consider undertaking research in appropriate technology for renewable sources of energy.
  
- (iv) Recommendation 4: To remove impediments to cross-border investments for energy diversification projects and devise a conducive set of policies and incentives toward a more viable energy mix.
  
- (v) Recommendation 5: To promote greater use of natural gas in the short run, e.g. hastening the development of the Trans ASEAN Gas Pipeline (TAGP) and reducing the heavy reliance on oil in the transportation sector.
  
- (vi) Recommendation 6: To propose that the ASEAN Centre for Energy (ACE) expand its scope of activities to cover all APT countries. In particular, the centre should pay more attention and channel more resources to energy conservation and diversification efforts.

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**Delegates to the Working Group on  
Energy Security Cooperation in East Asia**  
(in alphabetical order)

**Singapore**  
**Friday, April 27, 2007**

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**APPENDIX**

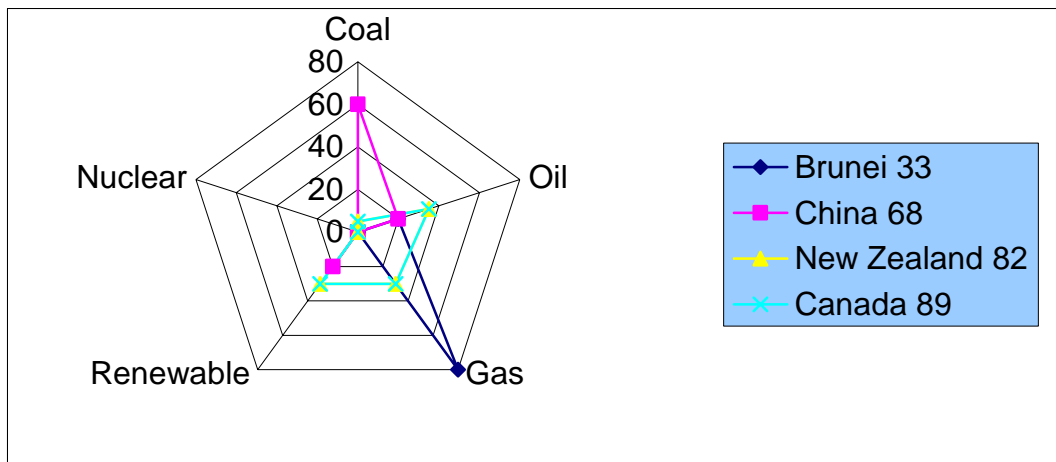
**Figure 1A: Energy Diversity Indicator (Points 1-100)**

Economy	1980	2002	2030(Forecast)
Brunei	14	33	45
China	68	68	65
Indonesia	62	84	86
Japan	53	78	86
Korea	50	74	89
Malaysia	50	63	77
Philippines	55	74	82
Singapore	1	28	47
Thailand	56	78	83
Vietnam	36	64	92
APEC	83	89	87

Source: APERC (2006)

Notes: Figure 1A shows the energy diversity indicator (assesses the distribution of energy sources in the primary energy mix for each economy in the range from 1 to 100 points) for the APEC region as a whole. A number closer to 0 indicates zero energy diversification whereas a number closer to 100 indicates full energy diversification. These figures are calculated by the Asia Pacific Energy Research Centre (APERC) using five main energy resources namely coal, oil, gas, nuclear and renewable energy resources (Figure 1B below). Among the ASEAN nations, the least diversified are Brunei and Singapore with an indicator of 33 and 28 in 2002, 45 and 47 respectively projected by 2030.

**Figure 1B: Energy Diversity Indicator for Selected Economies in 2002**



Source: APERC (2006)

**Figure 2: Estimates of Energy Consumption by Country & Source in 2005 (in Mtoe unless otherwise stated)**

	Fossil Fuels					Renewable Energy				TERU * (No.)	SMUR/ TEC (%)*	TOP 5/ TEC*	TFFU/ TEC*	TEC*
	Oil	Natural Gas	Coal	Hydro	Nuclear	Wind	Solar	Geothermal	Biomass					
China	327.3	42.3	1081.9	90.8	11.8	0.13	-	-	0.26	9 <sup>a</sup>	0.67	0.99	0.93	1554.5
Japan	244.2	73.0	121.3	19.8	66.3	-	-	-	-	9 <sup>a</sup>	0.47	1.00	0.84	524.6
Korea	105.5	30.0	54.8	1.2	33.2	-	-	-	-	9 <sup>a</sup>	0.47	1.00	0.85	224.7
Brunei #	0.6	1.6	-	-	-	-	-	-	-	2	0.73	1.00	1.00	2.2
Cambodia #	0.2	-	-	-	-	-	-	-	-	1	1.00	1.00	1.00	0.2
Indonesia	55.3	35.5	23.5	2.1	-	0.000 09	0.0002	0.47	0.036	9 <sup>a</sup>	0.47	1.00	0.98	116.9
Laos +	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Myanmar #	1.7	2.2	-	-	-	-	-	-	-	2	0.56	1.00	1.00	3.9
Malaysia	22.0	31.4	6.3	1.5	c	0.000 03	0.0000 7	1 PP in palm oil mill <sup>d</sup>	0.025	8	0.51	1.00	0.97	61.2
Philippines	14.7	2.7	5.9	1.9	-	0.000 2	0.0000 4	653 operational biogas systems <sup>d</sup>	b	8	0.58	1.00	0.92	25.2
Singapore #	42.2	5.9	-	-	-	-	-	-	0.026	3	0.88	1.00	1.00	48.1
Thailand	45.6	26.9	11.8	1.3	-	0.000 09	0.0003	1.67	0.065	8	0.52	1.00	0.96	87.3
Vietnam	13.0	4.5	10.4	e	-	-	0.0000 3	200 sites <sup>d</sup>	0.006	6	0.37	1.00	1.00	27.9

Source: Estimated using BP 2006 Statistical Review of World Energy and various compilation by authors

\*TERU: Total Energy Resources Utilized (all available statistics on the 9 energy resources) e.g. China utilizes all 9 energy resources in our study whereas Cambodia uses only 1 energy resource

TPEC: Total Primary Energy Consumed (include oil, natural gas, coal, hydro & nuclear energy)

TEC: Total Energy Consumed (sum of all available data on energy resources consumed by each country)

SMUR/TEC: Share of the Single Most Used Resource/ Total Energy Consumed e.g. Coal made up 67% of China's energy usage whereas oil made up just 37% of Vietnam's energy usage

TOP 5/ TPEC: Top 5 Most Used Energy Resources/ Total Primary Energy Consumed

a: In the cases of China, Japan, Korea & Indonesia, exact statistics for their solar, geothermal, biogas or nuclear respectively were unavailable. However, we know from various reports that these countries are using all 9 energy resources. b: Philippines use biomass, but data unavailable. c: Though Malaysia has one research nuclear power facility, it is experimental and thus not counted as an energy source.

d: Malaysia, The Philippines and Vietnam listed the number of geothermal plants instead of statistics.

e: Vietnam has hydropower but reliable data not available.

# : Brunei, Cambodia, Myanmar and Singapore are the least energy diversified.

+: Reliable data on Laos unavailable. For instance, Laos has tremendous hydropower potential but accurate realised power from this source is unavailable.